STAR Physics Program in YEAR-1

*J. Carroll and the STAR Run-Time Committee**

The STAR Run-Time Committee was formed in Sept. 1996 with the following charge from the spokesman - "In consultation with members of STAR, develop a realistic and detailed plan for STAR data-taking (considering experimental configuration, triggers, and beams) for the first year of operation at RHIC. An overview of anticipated data-taking in the second and third years of operation should also be developed in the context of what we presently know and anticipate for the future regarding evolution of the STAR detector configuration, RHIC operation and physics. "

The convenors of the STAR Physics Working Groups have assembled estimates of the number of events required to characterize **central** Au-Au collisions at 100 A GeV/beam. With ~100K events STAR can measure multiplicity and E_t distributions, single and double differential spectra in Y and M_t for $(\pi,K,p)^{\pm}$, single differential spectra for (K^0_s, Λ, Λ-bar), and 3-D HBT analysis for charged pions. The P_t and Y dependence of the HBT parameters, and analysis of event-by-event structure requires a sample of ~ 1 million events. Similar numbers of events in one or more event samples with a less restrictive trigger are required for a systematic study.

The anticipated operating conditions for the year-1 operation of the RHIC accelerator are contained in a document prepared by S Peggs (RHIC Accelerator Commissioning and the Year One Run - RHIC/AP/115). Integrating the expected luminosity growth, with STAR's operational duty factor and taping bandwidth shows that STAR could tape ~5 million **central** events if all the running were with AuAu @ 100 A GeV. With suitable triggers one could instead produce 'million-event' samples emphasizing several centralities.

This approach gives STAR a rather deep probe of only one part of the RHIC-physics parameter space - one energy, one species. A much larger exposure (integrated luminosity) of this type is eventually required by each of the experiments, and will be obtained in a shorter time when the full luminosity is available. Thus an alternative strategy for Year-1 is to make a beginning systematic study of the physics landscape available at RHIC using the physics observables that do not need large exposures. (For both STAR and PHENIX these are the ~100K samples listed in paragraph 2.)

Using the relevant design luminosities, assuming the same luminosity growth curve for each set of conditions, and with an allowance for transition times between operating modes, one calculates that in a 4 part program one can achieve the following numbers of events in each of 3 centrality selections:

AuAu @ 100 A GeV	300K
AuAu @ 50 A GeV	200K
SiSi @ 100 A GeV	600K
AuAu @ 100 A GeV	500K

(Note that the total number of events from AuAu @ 100 A GeV is ~1 million.)

The alternate energy and species given here are to some extent placeholders. These choices and the detailed make up of any real schedule must await early experience in operating the accelerator and experiments. If such attempts do not prove productive after some time, one can revert to the AuAu program at a calculable cost. In addition to making a broader physics survey in this completely new domain, this program offers the advantage of early testing of the technical capabilities of the accelerator over a large part of its operating range, with the consequent early start toward any necessary corrections.

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